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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/603,135	06/23/2003	Roy T. Hashimoto	SSR-001-2	9917

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EXAMINER	
LIEW, ALEX KOK SOON	
ART UNIT	**PAPER NUMBER**
2624	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/09/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/603,135	HASHIMOTO, ROY T.	
	Examiner	Art Unit	
	Alex Liew	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20-45* is/are pending in the application.

4a) Of the above claim(s) *1-19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20-25,29,31-38 and 42* is/are rejected.

7)☒ Claim(s) *26-28,30,39-41 and 43* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

The reply filed on 1/16/07 is entered and made of record and the applicant elects group I to be prosecuted, claims 19 – 45.

DETAILED ACTION

Claim Objections

Claims 26 – 28, 30, 39 – 41 and 43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

With regards to claim 26, the examiner cannot find any applicable prior art and suggestion disclosing adding a new planar group to the set of planar groups when a current 5D pose does not fit any planar group of the set of planar groups in combination with claims 23 – 25.

With regards to claim 39, see the rationale for claim 26.

With regards to claim 30, the examiner cannot find any applicable prior art and suggestion disclosing assigning a cross product of the first direction with a plane normal as a second direction of the multiple fiducial patterns in combination with claims 23 and 29.

With regards to claim 43, see the rationale for claim 30.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 20 – 23, 31 – 36, 44 and 45 are rejected under 35 U.S.C. 102(e) as being anticipated by Kosaka (US pat no 6,724,930).

With regards to claim 20, Kosaka discloses a method of pose estimation (in the specification the inventor described pose estimation is estimating the position and orientation of an object – page 67) using primary region representing a circular main fiducial and a second region representing an auxiliary fiducial (see fig 3 to 5– all the code markers shown has center circular marker, which is read as the main fiducial and anything outside of that circular marker in the middle are read as second region), the method comprising

calculating a plurality of moments of the primary region (see col. 8 lines 15 – 18 – the first and second moments are calculated in regions 1 of fig 7C),

characterizing the primary region as an ellipse based on the moments of the primary region (see col. 8 lines 29 – 31 – candidate marker regions are tested whether it is an marker region based on a threshold),

calculating a plurality of parameters for a 5D (five degrees of freedom) pose based on the ellipse (see col. 11 lines 5 – 39 – the coordinates of the markers in space represents the first three degrees, xi, yi and zi, and the image positions of the markers are the last two degrees, ui and vi, expression 9 are distance between the makers to the camera di and Di – the markers used are circular markers, but will be shaped close to an elliptical markers if see from an angle with respect to the object being observed – then the positions of the markers are calculated using expression 9 – u and v are calculated using expression 6 – 1) and

calculating a 6D pose using the 5D pose and the auxiliary fiducial (see col. 13 lines 22 – 37 – there are six pose parameters which represents three rotational components and three translational components – to calculate the homogeneous matrix which represents the six dimensional pose of the object the position of the markers are need, col. 9 lines 8 – 13 – the makers used here are circular as shown in fig 3 to 5 having a main and second region).

With regards to claim 21, Kosaka discloses a method of claim 20, wherein the calculating a 6D pose using the 5D pose and the auxiliary fiducial comprises calculating a centroid of the auxiliary fiducial (see col. 9 lines 5 – 8 – the center of the marker is the

centroid where it represents the position of the marker, the position of the markers are use to calculate the six dimensional pose).

With regards to claim 22, Kosaka discloses a method of claim 20, wherein the calculating a 6D pose using the 5D and the auxiliary fiducial comprises calculating the orientation of the auxiliary fiducial (see col. 13 lines 23 – 27 – once the orientation of the object is obtain, the orientation of the marker are also obtain because, the markers are placed on the object).

With regards to claim 23, Kosaka discloses a method of pose estimation for a plurality of regions based on a multiple fiducial pattern having a grid of main fiducial (see fig 1 – there are four markers placed on the object), the method comprising

calculating a plurality of parameters for one or more 5D of each region to generate a plurality of 5D poses (see col. 8 lines 1 – 31 – the parameters calculated are the moments for each candidate marker region, the positions of those recognized markers are then calculated, col. 11 lines 5 – 39, which are the 5D pose),

grouping the 5D poses into one or more planar groups (see col. 9 lines 41 – 48 and fig 8 – Q1, Q2 and Q3 are grouped into a plane) and

selecting the planar group with the most members as the plane of the multiple fiducial pattern (see fig 1 – the cube shape object only has one of the side marked with markers, which is selected plane).

With regards to claim 31, Kosaka discloses a method of claim 23, further comprising using identifying features to match one or more regions of the plurality of regions to fiducials in the multiple fiducial patterns (see fig 8 – the markers forms a triangle, which is the features use to form an image plane, col. 9 lines 41 – 44).

With regards to claim 32, Kosaka discloses a method of claim 341, wherein the identifying features provide orientation information (the distance information calculated, expression 7, between each marker provides information on the position of the marker, expression 9, which in turn use for calculating the pose of the object, col. 12 lines 62 – 67 to col. 13 lines 1 – 26).

With regards to claim 33, see the rationale and rejection for claim 20.

With regards to claim 34, see the rationale and rejection for claim 21.

With regards to claim 35, see the rationale and rejection for claim 22.

With regards to claim 36, see the rationale and rejection for claim 23.

With regards to claim 44, see the rationale and rejection for claim 31.

With regards to claim 45, see the rationale and rejection for claim 32.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 24 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosaka ('930) as applied to claim 23 further in view of Zhou (IEEE pub titled "Morphological Skeleton Transforms or Determining position and Orientation of Pre-Marked Objects").

With regards to claim 24, Kosaka discloses all of the claim elements / features as discussed above in rejection for claim 23 and incorporated herein by reference and calculating a pose center for each 5D (see fig 8 – the positions of Q1, Q2 and Q3 are calculated expression 9 – the pose center represents the position of a marker), but fails to disclose calculating pose normal. Zhou discloses calculating a plurality of parameters for one or more 5D poses of each region to generate a plurality of 5D poses comprises calculating a pose normal for each 5D pose (see section 4, in fig 3 **n** is the normal of the circular marker and is calculated using equations 11 and 12, page 303 top of second column). It would have been obvious to one having ordinary skill in the art at the time of the invention was made to include calculating pose normal because the circular shape

of the marker, seen from an angle, will always be seen as an elliptical shape, by calculating the normal to the marker, the orientation of the object can be determine.

With regards to claim 37, see the rationale and rejection for claim 24.

3. Claims 25 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosaka ('930) in view of Zhou as applied to claim 24 further in view of Davis (US pat no 6,101,455).

With regards to claim 25, Kosaka discloses all of the claim elements / features as discussed above in rejection for claim 23 and incorporated herein by reference and assigning each 5D pose to a planar group based on the plane normal (see fig 2 – the image plane is normal to the direction to the camera shooting position), pose center (see col. 9 lines 3 – 6 – the center position of the marker is the designated position of the marker) and plane point (see fig 8 – the center of the image is the plane point), but fails to discloses assigning each 5D pose to a planar group based on pose normal. Zhou discloses assigning each 5D pose to a planar group based on pose normal (see fig 3 – **n** is the normal vector to the plane marker). See motivation for claim 24 for combining Kosaka with Zhou. But Kosaka and Zhou does not disclose assigning a set of planar groups wherein each planar group has a plane normal and a plane point (see fig 6 – n number of planes are calculated each having a plane normal, the plane is normal to the direction of the laser light and a plane point, there are three fiducial points

selected to create a plane, col. 9 lines 37 – 57).). It would have been obvious to one having ordinary skill in the art at the time of the invention was made to include assigning a set of planar groups because to find the plane to best represent the set of targets or fiducial points, which in turn enable the camera to take the improved orientation and positional images of the object to find the best orientation and position results for the object.

With regards to claim 38, see the rationale and rejection for claim 25.

4. Claims 29 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kosaka ('930) as applied to claim 23 further in view of Huang (US pat no 6,628,819).

With regards to claim 29, Kosaka discloses a method of claim 23, further comprising calculating a center difference between each pair of 5D poses to form a plurality of center difference (see col. 9 lines 62 – 65 and expression 7 – R_{ij} is the distance between marker i and j), but fails to disclose orientating multiple fiducial. Huang discloses a method orientating the multiple fiducial pattern based on the 5D poses with a center distance that most closely equals a grid distance of the multiple fiducial pattern (see fig 2 – M, the markers are placed at the perimeter of the rotating turntable, the markers which are opposite to each other with its center distance as the rotating axis). It would have been obvious to one having ordinary skill in the art at the time of the

invention was made to include orientating multiple fiducial because to find the best orientation to take images of the object to obtain shape of the object, which in turn improve finding the orientation of the object.

With regards to claim 42, see the rationale and rejection for claim 29.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alex Liew whose telephone number is (571)272-8623. The examiner can normally be reached on 9:30AM - 7:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Mancuso can be reached on (571)272-7695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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1/30/07

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